SUSTAINABLE CONSTRUCTION METHODS
(CIVL 3222)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) The following green rating system currently working in India
(a) LEED
(b) GRIHA
(c) BREEAM
(d) Both (a) & (b)

(ii) The purpose of using recycled materials in green building construction is
(a) Increase Construction Cost
(b) Contribute to Landfill waste
(c) Reduce the demand of new raw materials
(d) Enhance Energy Efficiency

(iii) The significance of the term "HVAC" in green building design
(a) Heating, Ventilation and Air Conditioning
(b) High Velocity Architecture Construction
(c) Hazardous Ventilation and Airflow Control
(d) Home Value Assessment and Certification

(iv) The purpose of green roof in sustainable construction
(a) Increase energy consumption
(b) Improved storm water management
(c) Reduce indoor air quality
(d) Minimize natural light penetration

(v) The renewable energy source is commonly integrated into green building systems for power generation
(a) Coal
(b) Solar
(c) Natural Gas
(d) Diesel

(vi) Indian emissions of CO_2 in 2010 averaged about
(a) 5-6% of global emissions
(b) 7-10% of global emissions
(c) 2-3% of global emissions
(d) 4-5% of global emissions

(vii) Economic development leads to increased per capita income which leads to
(a) Decreased environmental pollution
(b) Increased domestic consumption of energy
(c) Completeness
(d) All of these

(viii) As per latest study, various energy systems account for
(a) 60% of global CO_2 emissions
(b) 80% of global emissions
(c) 84% of global emissions
(d) 90% of global emissions

(ix) In the recent decade 2002-2011, global emissions have averaged about
(a) 40 $GtCO_2$/year
(b) 30 $GtCO_2$/year
(c) 60 $GtCO_2$/year
(d) 20 $GtCO_2$/year

(x) Lime pozzolana mortars can be
(a) lime-burnt clay mortars
(b) lime-rice husk ash mortars
(c) lime-combination pozzolana mortars
(d) all of above.

Fill in the blanks with the correct word

(xi) GRIHA means _____.

(xii) The full form of LEED is _____.

(xiii) Rice husk ash contains _____% of amorphous silica.

(xiv) The form of lime, where naturally leached out limestone is mixed with clayey impurities, is known as _____.

(xv) Burnt clay pozzolana used since ancient times is locally known as _____.

Group - B

2. (a) Define sustainable development. Mention various principles of sustainable development. *[(CO1)(Remember/LOCQ)]*

(b) Explain the causal chain and environmental consequences of fossil energy use. *[(CO1)(Remember/LOCQ)]*

(2 + 4) + 6 = 12

3. (a) Explain various forms of energies involved in production of building materials. Mention various energies of fossil fuels used in construction industry.
[(CO2,CO3)(Understand/IOCQ)]

(b) Calculate the net embodied energy required for production of hydraulic cement, used for concreting purpose. Consider the following data for calculation:
- Coal consumption- 85 kg/tonne of cement.
- Assume imported coal produces 22 MJ of energy.
- Fossil fuel used in brick kiln- firewood.
- Assume transmission loss of electricity – 20%.
- Consumption of electricity by Indian coal- 0.7 kg/kWh.

[(CO2,CO3)(Evaluate/HOCQ)]

5 + 7 = 12

Group - C

4. (a) Describe the types of roofs. *[(CO2)(Remember/LOCQ)]*

(b) Discuss briefly the types, materials and methods of curved roof surfaces.
[(CO2)(Remember/LOCQ)]

5 + 7 = 12

5. (a) What do you mean by **"Green Building".** *[(CO5)(Remember/LOCQ)]*

(b) Briefly explain the various energy saving methods and their application in sustainable construction. *[(CO4)(Apply/IOCQ)]*

3 + 9 = 12

Group - D

6. (a) Discuss various classification of Bamboo Construction using flow diagram.
[(CO3)(Apply/IOCQ)]

(b) What are the important aspects of low cost housing? *[(CO6)(Remember/LOCQ)*

8 + 4 = 12

7. Explain with diagram, standard size and dimension of precast structural elements in construction. *[(CO6)(Apply/HOCQ)]*

12

Group - E

8. (a) Explain the various alternative materials that can be used instead of river bed sand. *[(CO4)(Understand/IOCQ)]*

(b) Contrast the application of lime-pozzolana cements to burnt-clay pozzolana in construction industry as alternative sustainable construction material.
[(CO4)(Remember/LOCQ)]

6 + 6 = 12

9. (a) Describe the potential usage of stone in construction industry as sustainable construction material. *[(CO6)(Understand/IOCQ)]*

(b) Demonstrate the importance of load bearing masonry construction as a sustainable construction method. *[(CO4)(Understand/IOCQ)]*

6 + 6 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	38.54	41.67	19.79

Course Outcome (CO):

After the completion of the course students will be able to

1. Develop an understanding on sustainability.
2. Apply the knowledge on renewable energy conservation through material usage.
3. Develop an insight on environmental impact of building materials.
4. Relate the understanding of building materials and construction technique that are sustainable and energy efficient.
5. Demonstrate various aspects of green building construction and it's rating system applied throughout the world.
6. Apply alternate building materials in the construction of low cost houses.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*